35TH CONGRESS, 1st Session. } SENATE. { REP. COM. No. 317.

IN THE SENATE OF THE UNITED STATES.

JUNE 10, 1858.—Ordered to be printed.

Mr. MALLORY submitted the following

REPORT.

The Committee on Naval Affairs, to whom was referred the memorial of George T. Parry, "praying that the Secretary of the Navy be authorized to purchase his patent for an instrument, the object of which is to abolish the friction attending the thrust of propellers," have had the same under consideration, and report:

A similar memorial was presented to Congress at its last session, and this committee submitted to the Senate a report upon it, (see Report No. 447, 3d session, 34th Congress,) from which the following is an extract, to wit:

"If it were allowable, the committee could in no way communicate to the Senate so just and satisfactory a view of the nature and importance of the invention as by presenting to the inspection of each member of the Senate a working model of the 'Anti-friction box,' accompanied by a description of the various uses to which it is applicable in the naval service of the United States. In its power of reducing friction it is one of the most successful, no less than one of the most simple, inventions of the age. Hence it is peculiarly adapted to receive the pressure or weight occasioned by the forward thrust of a screw propeller.

"It may not be considered out of place to state that, upon the first introduction of the submerged screw propeller, much difficulty was experienced in obtaining the proper method of receiving the thrust and relieving the engine from the extra amount of duty required to overcome the enormous friction it occasioned. It seemed to be conceded that by the substitution of a rolling surface more revolutions of the wheel would be obtained without a corresponding increase of the pressure of steam, consequently greater speed, with *saving in fuel*, together with a diminished consumption of *oil* used in lubricating the thrust-bearing, and with that view a large number of experiments were made, but without satisfactory results.

"The attention of those interested was next directed to the discovery of some means of avoiding the continual liability of the rubbing surfaces of the thrust-bearing from becoming heated and abraded under pressure. Flanches or collars, disks of various kinds of metal placed at the end of the shaft were tried, and were but partially successful.

It was next deemed advisable to scatter the friction over many parts at one and the same time, a device which was gained by encircling the shaft with a series of rings having a bearing in grooves out on the pillar or thrust-block. In all of these anti-friction devices it may be seen that the full amount of friction, incident to the thrust, still continued, requiring an extra amount of power from the engine to overcome it. With all these disadvantages rubbing surfaces continued to be used, until Mr. Parry invented his singular and simple invention, which, in the opinion of your committee, is all that can be desired to produce a perfect rolling thrust-bearer for screw-steamers. Increase of power, with a saving in the consumption of fuel, which, in a sea steamer, is of the greatest importance, are the immediate and most important results of its application to the propeller shaft. This invention consists of a series of rollers made in the form of double frustia cones united at their larger ends, and running in grooves of nearly corresponding form. By their peculiar shape no increase of pressure or speed can make them deviate from their proper paths around a circle. Apparently, their shape is an innovation of the established rules of mechanics, but the committee have undoubted testimony of their uniform working, not only in the large frigates Wabash and Minnesota, but in other instances of their application."

The opinions thus expressed at the two last sessions of Congress by this committee of the utility and value of this invention have in no respect changed.

Upon a reference to the Navy Department, your committee have received a letter and the accompanying reports and certificates from the Secretary of the Navy, all sustaining their views.

Your committee, however, do not deem it judicious or expedient to recommend the purchase of the general right to use the "friction box" for the navy. Occasions may possibly arise when such a purchase might be just and proper, as, for example, when the invention or discovery, from its very nature, can be used by the government only. But in this case, the invention is as applicable to merchant as to naval vessels; it will become generally used, and the Secretary of the Navy, who is not only authorized, but bound to see to the efficiency of the navy, has ample authority to purchase the use of the invention for our ships, as private individuals may, when required. Every succeeding day evinces the progress of the mechanic arts, and however admirable may be the invention in question for the purposes designed, it may be improved or totally set aside by further invention or discovery.

Your committee asks to be discharged from the further consideration of the subject.

UNITED STATES NAVY YARD,
New York, March 31, 1858.

SIR: In obedience to your orders of August 21, we have completed our labors of the examination into the comparative merits of "Parry's anti-friction box," having reference to reports which have already

been made, and on the files of the Navy Department, and also how far this improvement has been introduced into the mercantile marine, and have the honor to report the results.

At the time of commencing our investigations, we had no data on which we could base an opinion or determine the relative merits of this improvement, except the reports on file in the Navy Department, which were conflicting and not sufficient to satisfy our minds of the facts.

The first report on file was made at Philadelphia, November 24, 1855, by Chief Engineers Gay, Archbold, and King, on board the the steam-tug "Wm. F. Cushing," a small high-pressure screw propeller. The following is a synopsis of this report:

The steam pressure was maintained as nearly as possible at one point—60 lbs. per square inch—the trial with the "collar thrust" bearing continued three hours and thirty minutes; whole number of revolutions made, 13,194, or 62.8 per minute. The trial with the "Parry box" was continued three hours and eleven minutes; whole number of revolutions made, 12,512, or 65.5 per minute, which gave an excess of revolutions with the "Parry box" of 2.7 per minute, with about the same pressure of steam.

The consumption of coal is not correct, as the report states, owing to the manner in which the draught was produced.

"During this trial the 'Parry box' gave no indication of heating, nor had it any appearance of wear from long use; this is corroborated by those using it on the 'America' and other places. Aside from any gain in the consumption of fuel, we consider the 'anti-friction box' to combine many advantages; it is simple in its construction, cannot easily get out of order, and if it should, can be repaired without difficulty."

The next report was made February 14, 1857, by the engineer-in-chief of the navy, Daniel B. Martin, esq. This report is based entirely upon theory, on the facts developed by the former report, and has no bearing on the subject. Engineers Gay, Archbold, and King only ground their report on the difference of revolutions made with the same pressure of steam in each case, consequently time, distance, nor coal are not elements in this case. The following is the report:

OFFICE OF ENGINEER-IN-CHIEF,
February 14, 1857.

SIR: In obedience to your order to report on the economical values of the two "thrust" bearings tested in the steam tug-boat Wm. F. Cushing, as reported by Chief Engineers Gay, Archbold, and King, November 24, 1855, I have the honor to report, that by taking the data in accordance with their report, correct results could not be obtained, inasmuch as the fuel does not correspond with the revolutions made, or the revolutions with either speed or distance.

In their report they say that "the coal cannot be considered correct" for reasons which they give, but the difference between the revolutions and the speed also shows a difference in the load, tide, or distance in the two trials.

I have been furnished with a copy of their journal, from which I take the following:

"Passage down, 'common thrust;' revolutions, 5,070; time, 83 minutes.

"Passage down, 'patent thrust;' revolutions, 5,012; time, 77 minutes.

"Passage up, 'ccommon thrust;' revolutions, 8,090; time, 128 minutes.

"Passage up, 'patent thrust;' revolutions, 7,500; time, 114 minutes."

Had there been, during the passage down, an equal advantage in loads, tide, and distance, the slower speed should have made the least number of revolutions in proportion to the distance, the tide would have carried them in the difference between the times as the same revolutions of screw should have carried them an equal distance through the water under similar circumstances. The distance propelled for each revolution of the screw is not in any way affected by the "thrust bearing."

The results can be approximated by taking the revolutions, pressure, time, and coal in one case, and the revolutions and pressure in the other, and from thence find what should be the coal and time in the former case under similar circumstances of load, &c.

"*Common thrust.*"—Total revolution, 13,194; revolution per minute, 62.66; time, 210 minutes; coal, 1,182 lbs.

"*Patent thrust.*"—Total revolution, 12,512; revolution per minute, 65.55; time, 191 minutes; coal, 765 lbs.

Taking the data for patent thrust as the basis of calculation, we obtain as follows: $\frac{1}{1}\frac{2}{3}\frac{5}{1}\frac{1}{9}\frac{2}{4} \times 765 = 807$, and as the relative volume corresponding to 60 pounds pressure is to the volume of 60.5 pounds, so is 807 to 802; then reducing this to the same number of revolutions in each case, it becomes $\frac{1}{1}\frac{2}{3}\frac{5}{1}\frac{1}{9}\frac{2}{4} \times 802 = 760$, or five pounds less coal than with the patent thrust for the difference of pressures, but the times are as 191 to 199 in favor of the patent thrust.

The average revolutions per minute stands as 62.66 to 65.55, also in favor of the patent, but when these are equalized to the revolutions due to the pressures they stand as 63.20 to 65.55, the respective squares of these results indicating the relative gain, the former 8 and the latter 7 per cent. But if the load, tide, distance or other conditions apart from the thrust varied in the two trials, this result would be vitiated in the same ratio. The ordinary thrust used upon this occasion was an imperfect affair as would appear from the following extract from their report: "The ordinary thrust bearing used was quite rough from overheating, consequent upon which more power was absorbed in friction than otherwise would have been."

I am not aware of any satisfactory data from which correct conclusions can be deduced as to the real value of this invention.

I am, respectfully, your obedient servant,

DANIEL B. MARTIN,
Engineer in Chief, U. S. N.

Hon. J. C. DOBBIN,
Secretary of the Navy.

The next report was made February 6, 1857, by Chief Engineer King; this report does not give any material facts in relation to economy of fuel but it being important to show the merits of the invention, we insert it:

UNITED STATES STEAM FRIGATE "WABASH,"
Brooklyn, New York, February 6, 1857.

SIR: In compliance with your order, directing me to report the results of any trials or experiments made here with "Parry's anti-friction box," in comparison with the ordinary "thrust bearing," I have to state that no experiments have been made on board this vessel for the purpose of testing the relative value of the two kinds of instruments as regards economy of fuel.

It was my intention, from the first application of the patent thrust to this ship to make careful and accurate experiments of comparison; but we have been obliged to depend entirely upon the patent thrust, and have not as yet deemed it prudent to use the ordinary one sufficiently long to conduct the experiments.

During our voyage to Aspinwall, I removed the whole power from the patent to the ordinary thrust, with the intention of using it several hours, and noting the results necessary for calculation; but it soon began to heat, and as we already had much difficulty in keeping other bearings sufficiently cool to work them, I reluctantly abandoned the attempt to use it hence to secure necessary data.

It may not be out of place here to say that the "patent anti-friction box" has given more than ordinary satisfaction to the engineers of this ship. It is durable, correct, and beautiful in its operation, requiring no attention, except a few drops of oil occasionally. Up to this time, it shows no evidence whatever of wear, nor is there the slightest probability of its getting out of order within the next ten years.

I consider the invention a highly important and valuable appendage to screw steamers.

Respectfully, your obedient servant,

J. W. KING,
Chief Engineer United States navy.

Commodore PAULDING,
Commanding United States Home Squadron.

The next report, found on the files of the "department," was made May 19, 1857, by Chief Engineers Williamson, Follansbee, and Archbold, based upon trials made on board of the United States steam frigate "Minnesota."

UNITED STATES NAVY YARD,
Philadelphia, May 19, 1857.

SIR: In obedience to your order of the 9th instant, we have tested the relative advantages of the two plans for receiving the thrust of the propeller on board the "Minnesota," and respectfully report that in order to arrive at reliable results the engines, &c, were operated, on the 15th instant, with the "collar thrust," and again on 16th instant with "Parry's thrust;" the same amount of fuel expended on both occasions, the times of tides, pressures of steam, revolutions of engines, expansion, and all other conditions that would affect the results, were carefully observed, rendering the trials (as nearly as possible) similar; the experiments were continued, on both trials, until the steam had fallen to five pounds per square inch.

The result of the experiments is shown by the enclosed logs, from which we find the number of revolutions with "Parry's thrust" to exceed those made with the "collar thrust" by 387 revolutions, or 5.43 per cent., which we take to be the saving in fuel; the oil used on the "collar thrust" was eight times the quantity used on "Parry's." The hot journals, different states of atmosphere, and reduced average of vacuum on the first day's trial, was somewhat in favor of "Parry's thrust."

In estimating the value of "Parry's thrust" for each vessel, it is, in our opinion, necessary to consider, carefully, the saving of fuel and oil, and the security from heating the thrust bearing, which is far removed from the eye of the engineer of the watch; also in limitation of its value, to consider the proportion of time which the machine will be used, the absolute necessity of using it at all, and the probability of its being superseded by other contrivances.

After a careful consideration of all these elements, we are of opinion that a fair valuation would be two thousand dollars ($2,000) for its use in each vessel of similar size and power to the "Minnesota."

We are, respectfully, &c., your obedient servants,
WM. P. WILLIAMSON,
JOSHUA FOLLANSBEE,
SAMUEL ARCHBOLD,
Chief Engineers, U. S. N.

Commodore CHARLES STEWART,
Commandant Navy Yard, Philadelphia.

Steam log kept at the time of testing the collared thrust on board the "Minnesota," navy yard Philadelphia, May 15, 1857.

Time.	Steam.	Vac. F.	Vac. A.	Temp. H. well F.	Temp. H. well aft.	Throttle.	Register.	Remarks.
M	15	23	21	100	100	2¼	24355	At 9′ 31″ a. m. started fires; used 90 feet of kindling-wood; raining; atmosphere in a bad state for combustion; temperature of water in boiler, before firing up, 75° Fahrenheit; when steam was raised water and steam in top gauge-cocks.*
52″ P. M	10	25	24	99	100	2¼	25780	
1′ 5″ P. M.	14	26	24. 5	88	92	1½		
2″ P. M	13	25. 5	25	92	94	1½	27493	
3′ P. M	14	25. 75	25. 4	97	98	1½	29371	
3′ 30″ P. M	12	25. 5	25. 2	96	96	1½	30255	
4″ P. M	8	25	25	96	95	1½	31121	
4′ 13″ P. M	5	26	25	96	96	1½	31482	

* Started engines at meridian; stopped engines at 52″ p. m. to cool middle journal of centre shaft. Started engines again at 1′ 5″ p. m. Thrust bearing warm at 1′ 55″ p. m. Thrust bearng hot, put on water, which increased the revolutions from 31 to 34 per minute. Stopped firing at 3*h*. 30″ p. m. Stopped engines at 4*h*. 13″ p. m., steam having fallen to five pounds. Coal consumed in the trial = 137½ buckets, weighing 115 pounds each = 15, 812. 5 pounds. Oil used on thrust bearing = three pints. Register started at 24355; at 4*h*. 13″ p. m, stood at 31482. Revolutions made during trial, 7, 127.

Steam log kept at the time of testing Parry's thrust, on board the Minnesota, navy yard, Philadelphia, May 16, 1857.

Time.	Steam.	Vac. F.	Vac. A.	Temp. H. well F.	Temp. H. well A.	Throttle.	Register.
53*m.* p. m	15			Started	engines.		31525
1*h.* p. m.	14	25.9	26.1	89	92	2	31716
2*h.* p. m.	12	25.4	25.5	99	98	1	33536
3*h.* p. m.	14	25.6	26	100	101	1	35366
4*h.* p. m.	8	25.7	26.4	98	98	1	37170
5*h.* p. m.	7	25	26	102	100	1	38503
5*h.* 20*m.* p. m.	5	25	26	100	98	1	39039

REMARKS.—Started fires at 10*h.* a. m.; used 90 feet of kindling wood; atmosphere in a good state for combustion. Temperature of water in boilers, before firing up, 63° Fahr.; when steam was raised, water and steam in top gauge-cocks; started engines at 53*m.* p. m. Thrust, by dynamometer, at 30 revolutions, 21,300 pounds. Engines working well and journals cool; at 1*h.* 30*m.* p. m., a little water on crank pins; all other journals and bearings cool and oiled. At 4*h.* 7*m.* p. m., stopped engines 13*m.* to correspond with stoppage of the 15th instant; at 4*h.* 20*m.*, started engines; at 5*h.* 20*m.*, stopped engines, steam having fallen to 5 pounds. Coal consumed in the trial, 137½ buckets, weighing 115 pounds each, 15,812.5 pounds. Oil used on Parry's thrust, 1½ gills. Register started at 31525; at 5*h.* 20*m.* p. m., stood at 39039. Revolutions made during trial, 7,514.

The next was made by the engineer-in-chief, May 21, 1857; this report is based upon the data given in the last.

OFFICE OF ENGINEER-IN-CHIEF,
Washington, D. C., May 21, 1857.

SIR: In obedience to your order I have examined the trials made on the United States steam frigate "Minnesota," of the "Parry," and common thrust, and from the logs kept have deducted the following table:

Time of engines in operation.	Total number of revolutions made.	Average revolution per minute.	Average pressure of steam.	Average vacuum.	Average throttle.	Time of burning coal.	Coal consumed.
						h. *m.*	
Common thrust, 4*h.*	7127	29.695	11.1	24.51	1.66	6 42	15,812.5
Patent thrust, 4*h.* 14*m.*	7514	29.583	10.7	25.7	1.16	7 20	15,812.5

From the remarks of the different day's trials, it will be observed that on the day the common thrust was tried the weather was rainy and the atmosphere in a bad state for combustion; the day the "Parry" thrust was tried, the "atmosphere was in a good state for

combustion." The engines were not in as good condition for trial on the former as on the latter—the journals getting warm, and the vacuum being poorer; this difference in the vacuum I consider nearly or quite equal to the difference made in the revolutions. There was also a difference in time, the patent thrust running 14 minutes longer than the common thrust, whilst the average revolutions per minute with the common thrust is the greatest. Had the unconsumed fuel in the furnaces been weighed after each trial, and indicator diagrams been furnished, a more correct conclusion could be "approximated;" but I do not consider, that in the manner these trials were made, a correct conclusion can be reached, the difference between the two thrusts being so trifling.

Arrangements have been fitted to the ship for testing this in a much more accurate manner, which does not appear to have been used in this trial. I do not consider that from this trial alone correct conclusions can be arrived at, to the settlement of so important a question; and, further, as greater pressures can be brought on the thrust when the vessel is at rest than when making headway, and which is somewhat in favor of the "Parry thrust," I would therefore respectfully recommend that another trial by the means fitted for that purpose be ordered.

I am, very respectfully, your obedient servant,

DANIEL B. MARTIN,
Engineer-in-Chief.

Hon. I. TOUCEY,
Secretary of the Navy.

The next and last report found on the files of the department was made June 23, 1857, by Chief Engineers Williamson, Archbold, and Quinn, on board the steam frigate "Minnesota."

UNITED STATES STEAM FRIGATE "MINNESOTA,"
Hampton Roads, June 23, 1857.

SIR: In obedience to your order of the 1st instant, we have this day made further experiments for the comparative trial of the "Parry anti-friction thrust" on the plan proposed by the engineer-in-chief of the navy, viz: by taking the thrust alternately for five minutes on the "Parry" and "collar thrust," under similar pressures of steam, vacuum, throttle, &c., &c., and using the "dynamometer" for the purpose. There was so little end play in the "collar thrust," that the spring in the levers, &c., of the "dynamometer" would not effectually keep the surfaces out of contact at the time when the "Parry thrust" was in use; there was, consequently, no difference in the revolutions, so that we cannot determine its value, as no saving of fuel, &c., was shown by these experiments.

When the "collar thrust" was in operation we found it impossible, after several trials, to run it the five minutes consecutively without the use of water, which would ultimately seriously injure the journal; so that, fitted as it is on board this ship, we consider the "Parry thrust" necessary to the "Minnesota." But as we are not altogether

satisfied with the accuracy of the results of either this or the former trial, we would respectfully recommend that the experience of the engineers on board the "Minnesota" and "Wabash" be taken after trials of the two methods of taking the thrust, for several months, before the value of "Parry's thrust" to the government can be satisfactorily arrived at.

Very respectfully, &c., your obedient servants,

WM. P. WILLIAMSON,
SAMUEL ARCHBOLD,
M. QUINN,
Chief Engineers United States navy.

Hon. I. TOUCEY, *Secretary of the navy.*

The foregoing reports not being sufficient to satisfy our minds of the value of this improvement, and at this time there being no other information we could obtain of a practical character, we resolved to test the relative friction of the two modes of receiving the thrust by an experiment made with a collar thrust of reduced size, and a corresponding "Parry anti-friction box" on the same shaft, and measure the power exerted under several pressures to overcome the friction. In this many difficulties were encountered: 1st, to measure the power with any degree of accuracy; and, 2d, to determine what is the amount of thrust exerted on any power of engines, even when the pitch of the propeller is known.

By these experiments we were enabled to establish the fact that the friction decreased with the increase of speed, and that the "collar bearing" generated heat rapidly under the greater speeds. This instrument we were unable to keep in motion but a short time without stopping to cool the "collars," while the "Parry box" gave no indications of heating by continued use under any pressure which we put upon it.

We also satisfied our minds that the relative difference of friction in the two modes of receiving the thrust was very great, and that the friction with the "Parry box" was not much altered by an increased load or speed, while the friction of the "collar thrust" rapidly increased with the load, and hence the cause of generating heat; also, that the ratio of friction is much less with the "Parry box" in large steamers than small, because the rollers are of larger diameter, and this for the reason that the friction on the rollers is as the square of the diameter, and inversely as the pressure, while the friction on the "collars" increases with the load very rapidly, and that the collars required a much greater amount of oil than the rollers.

Since making these experiments we have been favored by the engineer-in-chief of the navy with an abstract of the "steam log of the frigate Wabash," which embraces practical experiments made on board of that ship, in her late cruise, under different circumstances, which appear to establish the advantage of the "Parry box" over the common "collar thrust." The following are the condensed results of these trials:

RESULTS.—EXPERIMENT No. 1.

Average per hour.

	Knots.	Revolutions.	Coal.	Steam.	Throttle.	Ashes.
Collar thrust	7.00	42.67	2770.5	11.7	6.8	396
Patent thrust	7.08	42.56	2440.0	10.54	7.56	529
		.11	330.5	11.6	.....	133

In favor of the patent thrust 330.5 pounds of coal per hour.

Collar thrust 60,953 pounds of coal divided by revolutions 56.328, equals 1.08.

Patent thrust 29,280 pounds of coal divided by revolutions 32.528, equals .9.

With the collar thrust 10.8 pounds of coal produces one revolution.

With the patent thrust, 9 pounds of coal produces one revolution.

RESULTS.—EXPERIMENT No. 2.

Average per hour.

	Knots.	Revolutions.	Coal.	Steam.	Throttle.	Ashes.
Collar thrust	7.25	43.95	3209	11.46	8.	769
Patent thrust	8.01	44.28	2920	10.06	7.6	655
		.33	289	1.40	.....	114

In favor of the patent thrust 289 pounds of coal per hour; or—

	Pounds of Coal.		Revolutions.	
Collar thrust	38,503	÷	31,584	=1.22
Patent thrust	34,144	÷	31,814	=1.07

With the collar thrust 1.22 pound of coal produces one revolution.

With the patent thrust 1.07 pound of coal produces one revolution.

The difference in speed is due to the sails.

RESULTS.—EXPERIMENT No. 3.

Average per hour.

	Knots.	Revolutions	Coal.	Steam.	Throttle.	Ashes.
Collar thrust	8.1	42.9	2492	9.5	8.	324.9
Patent thrust	7.4	43.8	2735	9.93	5.6	413.0
		.9	243	.43	.....	88.1

In favor of the collar thrust 243 pounds of coal; or—

	Pounds of Coal.		Revolutions.	
Collar thrust	24,920	÷	25,758	= .96
Patent thrust	27,348	÷	26,274	=1.04

With the collar thrust .96 pound of coal produces one revolution. With the patent thrust 1.04 pound of coal produce one revolution. The difference in speed is due to the sails. In this experiment the collar thrust had the advantage of new fires to start with, as the difference in ashes show.

Aggregate pounds of coal to produce one revolution.

Collar thrust.	*Patent thrust.*
1.08	'9
1.22	1.07
.96	1.04
3.26 ÷ 3 = 1.0870	3.01 ÷ = 1.0037
1.0037	

.0843 in favor of the patent thrust.

When the steam power of a ship is assisted by sails or favorable weather, the effect is to increase the number of revolutions, and decrease the ship, the amount of coal burned and power developed being the same.

If we take the difference of speed of the "Wabash" as due to the sails, we shall arrive at the true comparative performance of the machinery by multiplying the square of the retrograde velocity of the water which has received that velocity, and dividing the product by the pounds of coal burned. Let V = retrograde velocity of water in feet per minute. L = product of pitch into revolutions per minute. C = coal per hour. Then $\frac{L \times V^2}{c}$ = constant comparison.

The following are the results of the experiments:

Experiment No. 1.

	Knots.	Revolutions.	Coal.	$\frac{L \times V^2}{c} =$	Ratio of power.	Ratio of coal.
Collar thrust	7	42.67	2770.5	26128	1000	1000
Patent..do	7.08	42.56	2440	27328	1046	956

Experiment No. 2.

	Knots.	Revolutions.	Coal.	$\frac{L \times V^2}{c} =$	Ratio of power.	Ratio of coal.
Collar thrust	7.25	43.95	3209	20644	1000	1000
Patent..do	8.1	44.28	2920	13591	657	1521

Experiment No. 3.

	Knots.	Revolutions.	Coal.	$\frac{L \times V^2}{c} =$	Ratio of power.	Ratio of coal.
Collar thrust	8.1	42.9	2192	10845	1000	1000
Patent..do	7.4	43.8	2735	20662	1905	502

Mean results of three experiments.

	$\frac{L \times V^2}{c} =$	Ratio of power.	Ratio of coal.	Gain of patent.
Collar thrust	19206	1000	1000	
Patent thrust	20520	1068	936	6.47 per cent.

Thereby showing a gain of six and forty-seven per cent. over the ordinary "collar thrust bearing."

The following letters were likewise found on the files of the Navy Department, in reference to the utility of this improvement:

PHILADELPHIA, *April* 14, 1857.

GENTLEMEN: The patent anti-friction box has been in constant use since the 14th of May, 1852. Before applying the box, we used a collar on the shaft, such as are generally used on propellers; we found that the box increased the number of turns from $2\frac{1}{2}$ to $3\frac{1}{2}$ per minute with the same power of engine; running light, our average number of turns is 400,000 per month. It does not require oiling one tenth as often as the old bearing, and, from careful observation, I cannot perceive that the rollers or plates have worn at all during the last year. The old collar used has constantly been heating, and we were forced to pass a stream of water around the shaft to cool it. I have not known the "Parry box" to heat since we used it.

I am of opinion that if the box had been placed nearer the propeller, a still greater number of turns would have been gained. I regard the box as an invaluable addition to our steamer.

J. M. BURKET,
Engineer of Steamer America.

The COMMITTEE OF SCIENCE AND ART,
Franklin Institute.

STEAMSHIP "CITY OF BOSTON,"
Philadelphia, December 27, 1854.

In August, 1854, Parry's anti-friction box was attached to the shaft of the steam propeller "City of Boston," running between this port

and Boston. The rollers and box continue in perfect order, and I am convinced that it is better than any thrust bearing I know of.

Since its application it has never been known to heat; neither do I think it possible to do so, let the revolutions of the wheelbe what they may. From its entire absence of friction a saving of at least one tenth of oil is effected. It is a decided gain in power of at least three turns per minute, and in a heavy sea-way, where all the power of the engine is required, it proves its value by relieving us of all apprehension of the heating of the thrust bearing.

WM. A. PENN,
Chief Engineer.

BORDENTOWN, *New Jersey.*

In July, 1853, I attached Parry's anti-friction box to the shafts of the steam propeller Amboy. It receives the back and forward thrust of the wheels, each eleven feet in diameter. Since that time the boat has been running as a regular tow-boat from Richmond to Bordentown, and the rollers and box are now in as good order as when first applied, and I am convinced, by thorough practice, that it is the best thrust bearing that can be used.

It does not heat or corrode, requires very little oil, and is a decided gain in power or usefulness over any rubbing surface that may be sufficient to resist the pressure of the forward thrust of a propeller shaft.

ROBERT ALLEN,
Sup't of Steamboats for Camden and Amboy Railroad Co.

From personal knowledge of the machinery and propellers on board the steamer Amboy, I fully agree with the foregoing statement as to its merits and decided gain in power over any rubbing surface that may be used for receiving the thrust of a propeller shaft.

ISAAC DRIPPS,
Late Sup't of Machinery for Camden and Amboy Railroad Co.

FRANKLIN IRON WORKS,
Philadelphia.

Mr. Parry having requested a statement from us of the practical working of his patent anti-friction box, we cheerfully subscribe our names to the following:

We placed his box on the steam propellor Bird, and so arranged it that the entire thrust of the vessel and shaft was received by the rollers and box, and it appeared to us that the friction incident to the forward thrust was almost entirely obviated. In no instance did the rollers or box show any heat during the rapid revolutions of the shaft. After four months' constant use on the Bird, and eighteen months on the steamer "America," we examined the rollers, and could not per-

ceive any signs of wear or of a rubbing or sliding friction taken place on either side of the cones.

We have made the box for the steamer America, six hundred and fifty tons; ship Peytona, eight hundred and fifty tons; ship City of Boston, six hundred and fifty tons; steamers Huron, W. F. Cushing, Uncle Sam, &c., &c., where it has proved its value in diminishing friction, making thereby a decided gain in the effective power of the engine, said gain and power being the difference existing between a rubbing friction and a smooth rolling surface.

JAMES T. SUTTON, &c.

STEAMSHIP PALMETTO, BOSTON LINE OF STEAM PACKETS.

I am well acquainted with the great advantages derived from the use of Parry's anti-friction box, by thoroughly testing it on the steamship "City of Boston."

When the ship was sold off the line it was in perfect order, and presented no appearance of wear from its hard service. The same kind of box is now on the shaft of this ship, and gives the same satisfaction. Independent of the increased number of revolutions it gives per minute over rubbing surfaces, which are always liable to get hot under pressure, I consider the saving it effects in oil alone, together with the certainty of it not heating, sufficient to justify myself in saying that it is invaluable as a thrust bearing for a steamship.

WILLIAM A. PENN,
Chief Engineer.

PHILADELPHIA, *January* 22, 1857.

SIR: In reply to your favor of the 20th, requesting my opinion of the "qualities of and usefulness over rubbing surfaces" of your conical roller thrust bearing for propellers, I would say that, from a knowledge of the principles involved in its construction, as well as observation of its qualities as developed on the United States steamer "Wabash" and other (merchant) steamships, I consider it superior to any form of thrust bearing in which rubbing surfaces are employed, on account of the reduced friction, involving less waste of power and less wear and tear than incident to collar bearings; and in large steamers the saving caused by reduction in these two items is of grave importance.

Very respectfully,

J. VAUGHN MERICK.

GEORGE T. PARRY.

PHILADELPHIA, *January* 13, 1857.

This is to certify that I was in command of the steamer "Wm. F. Cushing" when Parry's anti-friction box was placed on her shaft for a thrust bearing. At that time I was decidedly opposed to it being used on the shaft of the vessel, as I considered the principle of the invention to be in opposition to the general rules of mechanism. My partner insisted on having it, and promised if it did not suit me he would pay all expenses himself.

I therefore determined to test the utility of the invention to the utmost of my ability, and with that view I first accurately measured the diameter of the rollers and depth of the cone, and, after running the steamer for one year at ship-towing, and making from seventy-five to eighty turns of the shaft per minute, I had the box taken off, and, by measurement, could not perceive the least decrease in size of roller or depth of cone. In experimenting with the box, I secured the vessel to the wharf and run the engine at eighty pounds of steam with the common friction collar which we previously used for the thrust. I then removed it and placed Parry's box on the shaft, and, with the same pressure of steam, it made a difference varying from four to five turns per minute with a seven and a half feet propeller. The journals on the main pedestal, which had always previously heated, now worked perfectly cool; and, daily witnessing the ease of motion that the box gave to the engine, the gain in speed, and saving in oil, I was compelled to acknowledge that it was the invention above all for a propeller; and I unhesitatingly say that, in any steamer on which it may be placed, it will pay for itself by the saving of oil in one year.

W. P. CROPPER.

PHILADELPHIA,
January 23, 1857.

SIR: Your friction-box has been in use on the shaft of the "America" now four years; it has been most thoroughly tried, having been in constant use with heavy work. I consider it almost indispensable, not only saving great friction, but also a complete preventative from heating, which, prior to its adoption, was a great annoyance.

In consequence of the carelessness of the machinist in putting it on last summer, after some repairs had been done to the engine, he not adjusting it square with the shaft, we were compelled to have the box turned true again. This is the only repair it has ever required, and I have no doubt but that it would have never required repairs of any consequence for another period of five years, were it not for his carelessness.

Yours, &c.,

JNO. H. PENROSE.

President Philadelphia Steam Pump and Towing Co.

Mr. GEORGE T. PARRY.

We have also the honor to report that, at the commencement of our duties, we deemed it necessary to solicit such information from engine builders who had introduced the "Parry box" into the mercantile marine, as to its success and adaptation by them, as they might be able to furnish.

The following gentlemen have kindly acceded to our request:

SOUTHWARK FOUNDRY,
Philadelphia, August 29, 1857.

DEAR SIR: We have your favor of 28th instant, making certain inquiries in reference to the "Parry thrust for screw propellers," and reply to your questions as follows:

First. We have applied the above bearing to three steamers, viz:

1. The "North Carolina," 672 tons, single engine 56-inch cylinder, 4 feet stroke, geared $2\frac{2}{3}$, 3,010 square feet horizontal, tubular boiler surface.

2. The United States steamer Wabash.

3. The Phineas Sprague, 930 tons, single engine, 50 inches, 3 feet 8 inches stroke, direct acting, 2,200 square feet, rising flue boiler surface.

4. We are applying it to two steamers now building, each of about 300 tons, with double engines; cylinder 40 inches, 36 inches stroke, geared $2\frac{2}{3}$.

Secondly. "All the above being constructed by us with the 'Parry thrust,' we have never removed other forms to make way for it."

Thirdly. As to the advantages of the Parry thrust, we consider them to be: 1st. An entire absence of heating; a tendency to which may be found in all "sliding" surface bearings. 2d. A reduced friction, even under circumstances the most favorable for other forms of bearing, which reduction we consider inevitable where rolling bearings are substituted for sliding bearings, and from experiments of which we have cognizance, in which the Parry thrust was compared with two different kinds of thrust; in both cases the gain by reduced friction was sensibly felt on the engine, and amounted to a valuable per centage of the whole power developed, (at least five per cent.)

Fourthly. Since the Parry thrust was first brought to our notice, we believe that the length of the outer cone on the rollers has been much reduced; that the size of the rollers has been increased; and that steel faces have been inserted for the rollers to work on. Any other information possessed by us on the subject not enclosed in the foregoing is at your service.

Very truly yours,

MERRICK & SONS.

PENNSYLVANIA STEAM TOWING COMPANY,
Philadelphia, August 28, 1857.

Having thoroughly tested Parry's anti-friction box as a thrust bearing, we have it in use on the tugs belonging to our lines. In every instance it has given entire satisfaction, and its durability is beyond question.

S. FLANAGAN.

FRANKLIN IRON WORKS,
Philadelphia, September 2, 1857.

DEAR SIR: In reply to your inquiry concerning the value and usefulness of "Parry's patent anti-friction rollers," we beg to say that we have used them with entire success upon the following steam vessels, viz: "America," "Underwriter," "Peytona," "Polynesian," "Huron," "Uncle Sam," "Cushing," "Bird," "Arctic," (for the government,) and the "Boston." We think these rollers indispensable to all propeller engines, as they keep the shaft from wearing endways, and run almost without any friction on the collars, and consequently the journals keep perfectly cool and require a great deal less oil, and enable the engines to turn considerably faster.

We believe it is the best invention of the kind that we have ever seen or heard of, and we unhesitatingly recommend it to every one having propeller vessels. We cannot see how it can be dispensed with. All the above named vessels have this invention, and its results have been entirely satisfactory, and we have never known them to have any difficulty or get out of order.

Most truly, &c.,

JAMES T. SUTTON & CO.

WM. RICE, Esq.

PHILADELPHIA, *September* 8, 1857.

GENTLEMEN: Your inquiries as a board of examiners, appointed by the Hon. Secretary of the Navy to examine into the merits of "Parry's anti-friction box," as applied on board of steam vessels for taking the thrust of "screw propellers," we have thought it most desirable to give you a list of steamers with the different plans of thrust that we have built for the last few years:

1.	Condensing engines, using the collar thrust	26
2.	Non-condensing engines, using the collar thrust	40
3.	Non-condensing engines, using balls as thrust bearings	15
4.	Condensing engines, using balls as thrust bearings	3
5.	Condensing engines, using movable disk for thrust bearings	4
6.	Engines using Parry's anti-friction thrust	43

By the various experiments of the different thrusts, as per within statement by ourselves, as well as those having in charge the different engines, we are fully convinced, and do not hesitate in saying, that Parry's anti-friction box is the only thrust bearing now in use that is worthy of the name. It is simple, of great durability, and a saving of 75 per cent. over the collars, and 25 per cent. over the balls; not the least jar of the engine is experienced.

Great economy of fuel and oil, and we consider an engine is incomplete without them ; so much so, that we put them on at our own expense to all engines we build, giving us the credit we desire. In quick working engines for the navy their value would be hard to calculate, as we deem them of such importance that we put them to the smallest engine, working at times with 150 pounds of steam, and making 130 revolutions, and everything perfectly cool.

Respectfully, &c.,

REANEY, NEAFIE & CO.

PHILADELPHIA, *9th month* 19, 1857.

To the inquiries in yours of the 28th ult. we reply as follows :

Parry's anti-friction box has been applied by us to the steam-barge "Seymour," fitted with one non-condensing engine having a cylinder 20 inches stroke, 17 inches diameter. No other thrust having been applied to this boat, we cannot make a comparison, but we can say that it has been in use about a year, with satisfactory results.

It has also been placed by us on the tug "Mariner," of Wilmington, N. C., having a condensing engine with a cylinder 30 inches diameter, 26 inches stroke. The thrust was originally taken by a broad collar bearing against a wide flange of after bearing. The engine was recently lined up, and the valves adjusted when the box was applied.

Before its application, the average revolutions were 75 per minute, afterwards 83 per minute—an improvement of 8, one-half of which, or $5\frac{1}{3}$ per cent., is considered due to Parry's box.

Her owners are so much satisfied with her better performance, that a box has been ordered and made for another of their tugs, the "Equator," at present fitted with broad collar thrust.

The "Parry box," applied to the tug "America" of this port, has come under our supervision when making repairs to the engines. This boat has two condensing engines, with cylinders 40 inches diameter, 30 inches stroke. The thrust was originally a series of collars on main shaft, but was changed to the mode patented by Mr. Parry before we had any direct knowledge of its operation. Her engineer reported a gain of five revolutions per minute due to Parry's box. It works and looks well, no repairs of any consequence having been made since its first application.

We consider the advantages of Parry's box to be, a minimum amount of friction, very little if any wear, and consequently a saving of repairs and lubrication.

In common with some other engine builders, we have modified the shape of the rollers of Parry's box by cutting off the exterior frustrum and rounding the ends to a radius equal to their distance, when in place, from the centre of the shaft, and turning the exterior flanges of bed pieces to fit their curve ; but from the want of an extended trial we are not prepared to say if it be any improvement upon the original form, but we think it quite as good.

J. P. MORRIS & CO.

JESSE GAY,

Pres't of Board of Engineers, Washington, D. C.

Upon a careful examination of the Parry anti-friction box, we find that it is admirably adapted for the purpose of receiving a heavy revolving pressure, such as the thrust of screw propellers, &c.; its freedom from dangers of heating or abrading, and the reduced friction which it involves under any pressure and speed, makes it one of the best known instruments for the purpose, while the collar thrust bearing is one of the most unreliable, for the reason that in no instance which has come under our observation has it been used without more or less heat being generated; to destroy this heat water is run upon it, which increases the friction to an unknown extent, and at the times when the greatest power and speeds are required this danger is most imminent.

The mechanical construction of the Parry box is simple. Receiving its pressure upon rollers in the form of a double cone, a small portion of which slides on the disks; hence but a small amount of oil is required for its lubrication.

The collar thrust is constructed with a series of rings, presenting the surface of one side of these collars or rings to the stationary box; the whole of this side, therefore, rubs on the corresponding side of the box, to receive the thrust of the propeller, and hence its great friction and liability to heat.

From the evidences embraced in this report of the economy of power, which is indicated by the trials made on board of the United States steam frigates Minnesota and Wabash, together with the opinions of the several gentlemen whose letters are given, we are of the opinion that this improvement is worthy of adoption on all the screw steamships of the navy, and that the use of it will effect a saving of not less than 5 or 6 per cent. of fuel, with a still greater economy in proportion to the power on the small steamers. This fact is established by the several trials made on board of the Wabash during her late cruise.

Besides the saving of fuel, considerably less oil will be required for lubrication; which, according to the experience in our experiments, and also that of the trials made on board the Minnesota, will not fall short of two gallons for each day's steaming.

We are of the opinion that this improvement is better adapted for the purpose of receiving the thrust of screw propellers than any other mode which we have considered, viz: the "collars," which is the usual form of thrust; the "balls," or the "four-coned" English thrust; it possesses advantages over them all, being more reliable, involving less friction, less expense of repairs, and, finally, less danger of derangement.

We are, respectfully, your obedient servants,

JESSE GAY,
GEORGE SEWELL,
Chief Engineers U. S. Navy.

Hon. ISAAC TOUCEY,
Secretary of the Navy.

Forwarded by—

L. KEARNEY, *Commandant.*